Material for Nuclear Spin Tomography Magnetic Resonance Imaging (MRI)

Description

The invention relates to a material as defined in claim 1.

In todays interventional nuclear spin tomography MRI, it is desirable to utilize materials of a certain elasticity, such as is used in springs, in biopsy and other automated needles, cardiovascular or other cavity stents. Titanium based materials exhibiting low field distortion, image artifacts in nuclear spin tomography, are in part too brittle and with insufficient elasticity. Filigree structures imaging isn't optimal either.

It is the goal of the invention to present materials, which can optimally satisfy these characteristics. The inventive solution lies in the choice of materials. Suggested are stainless steels of a cobalt-nickel chrome-based alloy. The first alloy on a CoNiCr base consists of 42 to 48% cobalt by weight, 19 to 25% nickel by weight, 16 to 20% chromium by weight, 2 – 6% molybdenum by weight, 2 – 6% wolfram by weight, 2.5 to 7.5% iron by weight, as well as additives of titanium and beryllium. The material can be further hardened. It is breakproof and can be utilized for highly challenged small dimensional springs, which must also be antimagnetic.

The material is highly suitable for springs utilized in measuring and display instruments of all kinds, including torsion and coil springs, membranes and other springs requiring high resistance accuracy. It is equally suitable for stents. For this application it is drawn into tiny tubes and subsequently cut into stents. Stents are metallic spring elements that are inserted into cavities in the human body, e.g. cardiovascular vessels, in order to prevent them from closing. The stents are introduced into the body with the help of catheters that are in turn guided in by guide wires. The core of the guide wire frequently consists of a long spring wire and the material cited here is ideally suited for its manufacture.

The material exhibits a high degree of corrosion resistance. Its superior cold fabrication properties in conjunction with good temperability produces an exceptionally durable, fatigue-free substance, that in tempered condition offers very attractive long-term stability values in situations with both high and low metal fatigue windows. Furthermore, the alloy can be utilized in a permanent application up to the middle temperature range, i.e. from -50^0 C to 350° C. The material has an elasticity modulus of 219.5 to 234.4 kN/mm^2. Due its relative permeability of $<1.005\mu$ it cannot become magnetized in the nuclear spin tomography MRI or nuclear magnetic resonance unit. The material is biocompatible and can be used for implants in the human body.

Another material consists of 39 to 41% cobalt by weight, 15 to 18% nickel by weight, 19 to 21% chromium by weight, 6.5 to 7.5% molybdenum by weight, <0.15% carbon, <1.2% silicon by weight, <0.01% beryllium by weight, <0.015% sulfur by weight, <0.015% phosphorous by weight, as well as an iron additive. The mechanical properties

are similar to those of the first named materials, wherein the elasticity modulus (Youngs modulus) is at 212 kN/mm^2.

The materials are classified under the ISO 5832/7, AFNOR NF S 90-403, ASTM F1058-91 standards.

We claim:

1. Use of a material based on cobalt, nickel, and chromium for use in nuclear spin tomography MRI, used in stents, mechanical springs, and guide wires.

2. The material described in claim 1, defined as being comprised of 42 to 48% cobalt by weight, 19 to 26% nickel by weight, 16 to 20% chromium by weight, 2 to 6% molybdenum by weight, 2 to 6% wolfram by weight, 2.7 to 7.5% iron by weight, and titanium and beryllium additives.

3. The material described in claim 1, defined as being comprised of 39% cobalt by weight, 19 to 21% chromium by weight, 16 to 18% nickel by weight, 6.5 to 7.5% molybdenum by weight, <0.15% carbon by weight, <1.2% silicon by weight, <0.01% beryllium by weight, <0.015% sulfur by weight, <0.015% phosphorous by weight as well as the addition of iron.